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ABSTRACT

Research shows that learning in groups improves students' achievement of learning objectives. Some indicate that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Kearsley, 1996; Brandon & Hollingshead, 1999; Bernard et al, 2000). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research which indicates that when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? This question is a difficult one to answer, but this study begins to answer the question by investigating the quality of peer online discourse. This study discusses possible activities to enhance Web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities. In this study, complete electronic discourse transcripts of college students in a collaborative problem solving assignment will be analyzed to measure the quality of peer online collaboration with the two different methods, to help understand the group dynamics and types and patterns of social interaction which occur online. (Author/AEF)

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ED 470 141

Peer Online Discourse Analysis

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Short Description

This session will analyze peer online discourse on a collaborative team problem solving assignment in a large college class, in an attempt to understand the group dynamics in online collaborative environments. Issues and problems associated with peer online collaboration and implications for the possible roles of instructors and instructional designers will be discussed.

Abstract

Collaborative learning has been gaining increased attention in the practice and research of education. As Vygotsky (1978) points out, social interactions play a very important role in learning. Research shows that learning to work with a small group can promote group learning as opposed to individual learning. (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999). Computer technologies, as scholars believe, can support collaborative learning and be beneficial to learners in many different ways (Harasim, 1990; Bonk and King, 1998; Lin et al, 1999; Schwartz et al, 1999). Various forms of Computer Supported Collaborative Learning (CSCL) have now been widely used as supplements to traditional classroom learning as well as in distance education (Bonk and King, 1998).

Research shows that learning in groups improves students' achievement of learning objectives. Some indicate that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Kearsley, 1996; Brandon & Hollingshead, 1999; Bernard et al, 2000). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research which indicates that when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? This question is a difficult one to answer, but this study begins to answer the question by investigating the ***quality*** *of peer online discourse. This study discusses possible activities to enhance web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities.*

In this study, complete electronic discourse transcripts of college students in a collaborative problem solving assignment will be analyzed to measure the quality of peer online collaboration with the two different methods, to help understand the group dynamics and types and patterns of social interaction which occur online.

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Introduction

Collaborative learning has been gaining increased attention in the practice and research of education. As Vygotsky (1978) points out, social interactions play a very important role in learning. Research shows that learning to work with a small group can facilitate group learning as opposed to individual learning. (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999)

Computer technologies, as demonstrated in research and practice, can support collaborative learning and be beneficial to learners in different ways (Harisim, 1990; Bonk and King, 1999). Computer technologies, for example, make collaborative learning achievable even when face-to-face communications are less accessible, and more importantly, they can be designed to support delayed reflection (Lin et al, 1999; Schwartz et al, 1999).

Statement of the Problem

As computers and networking technologies are introduced into education, the form of education is changing dramatically. A variety of computer-supported education has been widely used to promote learning beyond the limits of geographic location and time. With technologies available today, learners can establish connections and contacts with instructors and peer learners beyond the traditional classroom. Computer Supported Collaborative Learning (CSCL) Tools, including online forums, facilitate learning by offering opportunities for interaction and collaboration. Online forums, as one of the most widely used CSCL tools, have been introduced to today's colleges to facilitate peer collaboration (Bonk and King, 1999).

In large classes, students often feel little attention to their individual needs, and may sometimes consequently feel isolated in the learning process. Active learning in large classes often occurs in group activities. This group collaboration has been shown to enhance learning (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999). Some research indicates that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research that shows when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach of peer online collaboration is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? Redundant with above, use one place or another, or re-word. This question is a difficult one to answer, but this study begins to answer the question by investigating the **quality** of peer online discourse and discusses possible activities to enhance web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities.

Research Question

This study begins to consider the question of online peer collaboration structures by investigating the quality of peer online discourse. More specifically, the study intends to explore if there are differences in the quality of students' online collaboration in the two types of online collaborative forums, and tries to understand why such differences, if any, occur.

Definition of Terms

In an attempt to alleviate any confusion due to the use of different terminology, relevant terms are defined based on how they are used in this study.

- Collaboration:

Mutual engagement of participants in a coordinated effort to reach a shared goal. Bruner (1991) defines collaboration as a process to complete tasks that cannot be fulfilled individually, or cannot be done efficiently otherwise. Mutual engagement includes joint efforts to develop a set of goals and directions; to share responsibilities; and to work together to achieve those goals, utilizing the expertise of each collaborator.

- Computer Supported Collaborative Learning (CSCL):

An learning method that implements information and communications technology to facilitate collaborative learning (Wasson, 1997, 1998).

- Online forum:

An asynchronous electronic means for communication and collaboration, where participants can post and respond to messages and discuss and collaborate on the Internet.

- Peer-controlled online forum:

A web-based bulletin board for peer learners to communicate with one another as they wish without moderation or any other active participation of the instructor.

- Structured and moderated online forum:

A web-based bulletin board for peer learners to communicate and collaborate, where the instructor takes active responsibility to structure, scaffold and moderate the collaboration.

- Problem solving:

" In general, problem solving involves dealing with new and unfamiliar tasks or situations that present some obstacle, and relevant solution methods are not known. In Gagne's conditions of learning, problem solving is the skill of recalling and applying a set of rules in the proper sequence to solve a problem. It is also referred to as higher-order rule learning" (Gredler, 1997, 364).

LITERATURE REVIEW

Sociocultural Theory

Vygotsky states that learning is a developmental process, and it occurs in social activities (Driscoll, 1994). One of Vygotsky's most influential contributions is to analyze human psychological development from a social-cultural history method (Gredler, 1997). As Vygotsky notes that higher ordered, complex thinking is gradually developed through social interactions with others in the culture (Gredler, 1997).

Consistent with sociocultural theory, research shows that learning in groups improves students' achievement in various learning objectives and some indicate that a role of facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). Research shows that successful group learning promotes higher order thinking (Blumenfeld et al, 1996).

As Vygotsky (1978) points out, the learning environment is critical, as people learn from people around them and are influenced by the culture of the learning context. According to Sociocultural theorists, people learn from mediations and scaffoldings, which are offered within one's zone of proximal development (ZPD) from more capable peers or expert (Wertsch, 1985; Gredler, 1997; Bonk and King, 1999). Vygotsky defines ZPD, one of the key concepts in the sociocultural theory, as the distance between one's independent competency and that obtained with assistance from the expert or in collaboration with more capable peers (Wertsch, 1985). Such a distance can be bridged by scaffolding, as external assistance is gradually reduced and the learner finally achieves independent competency in the task (Gredler, 1997). Research and scholarship also claim that computer supported collaborative learning environment can provide the Zone of Proximal Development (ZPD) (Salomon, Globerson and Guterman, 1989; Newman et al, 1993). In collaborative learning environment, learners' ZPD can be reached and extended through communications and collaborations with peers and the instructor. Also the applications of computer technologies can help scaffold within learners' Zone of Proximal Development in collaborative learning and therefore to promote learning outcomes.

Collaborative Learning

Collaborative learning, consistent with sociocultural theory, is gaining more and more attention in education. Social interactions play an important role in learning (Vygotsky, 1978); in fact peer group work can have significant impact on varied learning outcomes (Jonassen et al, 1995; Berge and Collins 1995).

Very often, independent and individual learning can leave a learner passive and inactive. Vygotsky (1978) suggests that collaboration should help individuals make progress through their zone of proximal development by the activities in which they are engaged. Collaborations in peer group work increase engagement in the learning

process, and facilitate cognitive development. Collaborative learning changes the traditional teaching and learning practice; the instructor is no longer simply the "knowledge giver" or the center of power in the learning process. Instead, peer collaboration transformed traditional education to learner-centered, active "learning" activities. In peer collaboration, learners share knowledge, ideas and significant thinking, and therefore learn from one another and achieve goals that may not be obtained in isolated individual learning. Interpersonal communications enable and encourage learners to confer, reflect and help to develop meaningful learning (Johnson and Johnson, 1975; Clements and Nastasi, 1988).

As students are led to reflect upon and confront different ideas in peer collaborations, to provide meaningful feedback and support to one another, Cazden (1988) suggests that learners therefore can learn in a constructive way and benefit in cognitive development. Research shows that to learn and work with a small group can facilitate learning as opposed to individual learning (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999).

Collaborative learning environments provide a means to create more engaging and dynamic instructional settings. Research frequently shows that there are clear educational advantages to be derived from collaborative activities among students (Del Marie Rysavy and Sales, 1991; Slavin, 1992).

Computer Supported Collaborative Learning

Computer technologies have further extended the formats of collaborative learning. Varied forms of Computer Supported Collaborative Learning (CSCL) have been adopted in education of both cognitive and affective domains (Clements and Nastasi, 1988; Hoopers, 1992; Repman, 1993; Jehng, 1997; Rada and Wang, 1998). Researcher (Dede, 1996) suggests that collaborative online learning should be integrated into higher education in the twenty first century.

Asynchronous online forums further facilitate self-paced and self-controlled learning and collaboration. Asynchronous online forums extend peer collaboration beyond the classroom, expand learners' control over the time for collaboration, and increase the time available to read, to reflect and to reply to a message and formulate ideas in writing. Scholars (Vygotsky, 1978; Harasim, 1990) believe that the change from oral to verbal communication also contributes to learning effectiveness when learners have to concrete and articulate their thinking in writing. Asynchronous online forums also extend the time span for peer collaboration, making it more flexible. Learners can conduct the collaboration online as long as needed, and therefore can possibly improve in-depth investigation of the collaborative task (Harasim, 1990).

Virtual discourse in online forums can be stored and easily retrieved, and hence can facilitate delayed reflection, and is always open to review (Scardamalia and Bereiter, 1994; Blumenfeld, et al, 1996). Technologies also make participants' thinking and reasoning visible (Lin et al, 1999). By requiring students to articulate their thinking, by facilitating comments and communications among learners, and by making it easy to view by thread, date or author, instructors can use asynchronous online forums to support delayed reflection. In addition, experiences indicate that some students that are not comfortable in classroom collaboration can be very active and engaged online, as there is no time restriction or competitions or interruption in the course of peer collaboration (Harasim, 1990). In asynchronous online collaborative environment, even less active learners can have the same time and opportunity to express themselves, without fear of being interrupted by more aggressive peers. In this sense, it can ensure equal opportunity in peer collaboration.

However, online collaboration forums do not simply make peer collaboration easier. First of all, asynchronous online collaboration is very different from face-to-face meetings. Participants communicate not in the real time but in the times at their individual choice. Yet the lack of non-verbal communication in an online forum makes misunderstanding and miscommunications less detectable, and thus requires higher communication competency in writing. Concerns for miscommunications can make participants more conscious and nervous about writing and diction in their online collaboration efforts. Second, learners may feel frustration with the technology itself. They may also feel like they are "talking to a vacuum" when no immediate response is available. In addition, consensus can be more time-consuming and is generally more difficult to achieve in online collaborations. Moreover, the quality of decision may be sacrificed to compromise delays caused in online collaboration (Harasim, 1990).

Scaffolding

Closely related to the Zone of Proximal Development is scaffolding. Scaffolding refers to varied forms of external support and assistance to learners to complete a task that is beyond their individual, independent efforts

(Gredler, 1997; Bonk and Cunningham, 1999). Scaffolding is also a process to gradually reduce expert assistance as the learner gets more and more competent at the task in the learning process (Gredler, 1997). Scaffolding efforts are to provide necessary assistance and therefore to help learners achieve the zone of unknown gradually.

Scaffolds can be provided by different external agents, teachers, peer learners or supporting materials (Wertsch, 1985; Gredler, 1997; Bonk and King, 1999). With computer technologies, several design features can be embedded to provide scaffolds such as process display, process prompts, process models and reflective social discourse (Lin et al, 1999).

As suggested by research and scholarships, the role of facilitator can smooth the process of collaborative learning (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). In collaborative learning environment, the role of instructor changes from the center of authority to a facilitator or co-conspirator (Hamm and Adams, 1992; Flannery, 1994). In the peer collaborative learning environment, the instructor does not serve as an information giver, but rather, learners have more active control over the learning process. In addition, students need to be engaged in a very rich context to collaborate and develop higher order thinking (Bosworth and Hamilton, 1994). Similar to traditional classroom collaboration, in online collaborative learning environment, the instructor can take the role of a moderator and facilitator as needed in the course of peer online collaboration. Supports that the instructor can provide in the learning process include motivating students, monitoring and regulating learners performance, provoking reflection, modeling, moderations and scaffolding (Brown & Palinscar, 1989; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Brandon & Hollingshead, 1999; Jonassen, 1999).

Forms of scaffolding can include hinting, elaborating, guiding, questioning, prompting, probing, simplifying, or other similar learning supports (Bonk and Cunningham, 1999). The scaffolding efforts can also be classified as conceptual, metacognitive, procedural and strategic scaffolds, as Hannafin et al (1999) suggest. Conceptual scaffolds are to guides students in what to consider; metacognitive scaffolds are to guide how to think during learning process; procedural scaffolds are to guide students how to utilize the available features in the learning environment; strategic scaffolds are to provide macro-strategy initially or ongoing as needs or requests arise so to guide students in analyzing and approaching learning tasks or problem (Hannafin et al, 1999). The various scaffolds can be embedded in a well-designed computer supported collaborative learning environment and therefore to enhance learning and improve cognitive performance.

Structuring and Moderating Online Forums

Some research documents that when participants have more active control over the learning process, learning increases (Jensen, 1996). Therefore less participation of the instructor may foster more active learning. But as some research indicates, participation in electronic discussion is often passive without instructor's participation. As Aviv and Golan (1998) report, most students in distance learning environments participate in electronic discussions by passively reading some peers' postings, and only responding to a few of others' messages, also very few students raise questions. Aviv and Golan (1998) also found that when preplanned, and focused, and students are led through the learning process, electronic discussions can lead to a highly successful learning experience. Scholars (e.g. Slavin, 1995) recommend the use of structured protocol to direct interactive discourse among peer learners so to reduce off-track and passive behaviors while ensuring opportunities for equal participation.

When shifting from the "center of authority" to "co-conspirator," the instructor needs to take substantial responsibilities in the course of collaborative learning in order to foster a learner-centered peer collaborative learning environment. As for students' participation in online collaborations, strong social skills and good group dynamics are essential to effective and productive learning outcomes. Group dynamics contribute to students' performance in collaborative learning and their satisfaction for the learning experience (Bosworth and Hamilton, 1994). Some participants' actions of "free riding" and "social loafing" and failure to contribution, however, can damage others' enthusiasm and motivation in the course of collaborative learning. In addition, the feeling of "talking in a vacuum" with online collaboration and other frustrations with technology and many other factors make online collaboration a challenge to many participants. Research indicates that even in learner-centered learning environment, as in online collaborative learning, moderations and structuring of the learning process are needed for successful learning experiences (Flannery, 1994). Online collaborations need to be well organized, facilitated, and moderated to be effective and successful (Hamm and Adams, 1992; Flannery, 1994).

Structuring

Little research has been focused on how to structure peer online collaboration. In practice, peer collaborations are often structured by the learners themselves by chunking the group assignment into "detailed

division of labor" (Althauser and Matuga, 1999). In order to reduce "free riding" in teamwork, instructors also often structure the online peer collaborations by assigning a set of questions to each member of a group. Therefore every group member must participate by taking charge of the part of the task to which they are assigned. Such structuring, however, has drawbacks, as it tends to lead students to work on the group assignment in a cooperative way and thus miss the opportunity for collaborative learning. Individuals can execute their own part of the assignment without collaborative efforts from peers, and they may not contribute to other part of the assignment either.

Bosworth and Hamilton (1994) suggest that instructors create and develop requisite structure and process of the group to achieve better collaborative learning. Similarly, Slavin (1995) suggests using structured protocols to direct student interactions. Efforts of structuring peer online collaborations in this study are two fold, one is to structure group work, and the other is to structure the collaboration in online forums.

Moderation

The importance of moderating peer collaborative learning has been recognized in practice and research (Harasim, 1990; Hamm and Adams, 1992; Bosworth, and Hamilton, 1994). Bernnard et al (2000) also suggest that instructors assume a facilitator's role in an online collaborative learning environment. Strategies for online forum moderation include, but are not limited to the following: to maintain the discourse focused on the topic, to check team progress, to promote equal participation, to provide individual support as needed.

Research Design and Implementation

The study was conducted in a large undergraduate introductory statistics course at a major university in the northeastern United States. As a required course by many majors at the university, this course included students from all majors and class standings. Forty-one groups, consisting of one hundred and forty eight students volunteered to participate in this study. All the participants were already experienced with teamwork in this course before the study began. Participants were given the opportunity to re-form teams of four or five each, based on their past team work experience with others in this course. The forty-one groups were then randomly assigned to either of the two types of forums (peer controlled or structured and moderated) and asked to collaborate on twelve problem solving scenarios in the online forums as a team assignment. As a result of the random assignment, twenty-one groups were using the peer-controlled online collaborative forum, and twenty groups were using the structured and moderated online forum. Each team was provided a private online forum, which only team members had access to. For each scenario, participants were asked to recommend an appropriate statistical technique to address the problem and provide justifications for the recommendation. The study took place in the last few weeks of the semester when students were extremely busy with finals, projects and exams for other course work, and participants had two weeks to work on the assignment before final submission. Before the study began, the participants had already experienced many technology-enhanced learning opportunities in this course, such as a course website, the password-protected web-based electronic textbook, online quizzes for individual assessment, and online forum for group and/or class bulletin board.

Teams assigned to the peer-controlled collaboration forums worked with their team members on the problem solving assignment without any intervention from the instructor or anyone else. Teams assigned to the structured and moderated collaboration forums, on the other hand, were closely monitored by the instructor and received scaffolding, moderation and structuring prompts from the instructor as needed.

Data Collection And Analysis

All the electronic transcripts of each group's discourse on the online forums were collected in a previous experimental study conducted by the lead researcher and analyzed with multiple -party discourse analysis principle applied. Since this research was interested in teams rather than individual behaviors, each team's electronic postings on the private forum were saved and analyzed as one single unit.

Data were stored and organized in NVivo, a Qualitative Data Analysis (QDA) software. The researcher also wrote memos for each group to record general impression and important thoughts each time reading and/or coding the transcripts, and those memos were then analyzed together with the electronic transcripts.

The data analysis was carried out as an ongoing process as the research proceeded. when the teams were using the online forums for the problem solving assignment, the first author read the electronic transcripts as they became available everyday and wrote brief memos to record ideas and impressions constantly. Reading the transcripts and recording initial ideas as an ongoing process helped the researcher to understand the dynamic nature

of teamwork and online collaborations. It felt like the researcher were experiencing the team process, learning and observing collaboration real time as the participants did. It enabled the researcher to capture the dynamic nature of teamwork without meeting any of the participants in person or interrupting/disturbing the team dynamics.

Some teams used the online forums, which were originally designed to be synchronous communication tools, for real time team collaborations. They set up a time that all members logged on and conducted the collaboration as if in a real time face-to-face meeting. In those incidences, the lead researcher, when she happened to be online exploring those forums, or when she knew the meeting time from their previous communications, then observed the team's online collaboration as if in a real-time observation.[13] While reading the team dynamics, the lead researcher took notes as if in a synchronous observation, and those notes were also analyzed together with the original transcripts.

When the team online collaborative assignment was due, all teams' online discourse was saved as electronic transcripts. Those electronic transcripts, which were collected in a previous experimental study (Zhang, 2000; Zhang & Peck, 2001) and now analyzed for an alternative perspective on and deeper understanding of the original questions, could be considered as secondary data (Hinds, et al 1997, Szabo and Strang 1997). Researchers (e. g. Hinds et al, 1997, Sandelowski 1997, Szabo and Strang 1997, Thorne 1994) argue that secondary data analysis can be deployed to revisit existing theories and/or generate new knowledge. The memos the lead researcher took, either when observing team collaborations real time or when coding and re-coding, were primary data. Both primary data and secondary data were analyzed together in this study.

As the research question was particularly interested in comparison, which is a basis of discourse analysis (Lemke, 199?), discourse analysis principles were very appropriate as an attempt to understand the team interaction pattern. As researchers (e.g. Lemke,199?) believe that language written or spoken, as research data should be translated from the activity in which it originally functions to the activity in which we are analyzing it. Also human discourse is, by nature, highly contextual, online or in person, thus it was critical for the researchers to visit and re-visit the electronic transcripts frequently through the study. And the real time observations played an important role in helping the researchers understand the context of the collaborations when they happened and hence enabled the researchers to interpret the language and interactive rhetoric as close as we could.

Researchers identity

The lead researcher was also the primary researcher of the study from which the electronic data was gathered so she understood the data collection process and the context in which it was generated. During the experimental study, where participants were first introduced to the online forum as a collaborative learning tool, the lead researcher was also working closely with the students and instructor of the course as the technical supporter and was actively involved in setting up the forums, facilitating re-grouping and provide resolving technical issues. Yet most of the contacts between the lead research and the participants were through email, the online forum or indirectly through the instructor. Since the experimental study only lasted for two weeks, lead researcher did not become to know any of the participants in person, nor did she become familiar with any of them. The physical and psychological distances, which were generated from the little personal knowledge and only electronic communications, served both good and bad for the research. On one hand, the distances enabled the researchers to be closely engaged with the data, the online discourse transcripts, while staying detained from the participants. Thus the researchers were able to study the groups with little personal bias on particular participants. Yet on the other hand, in the data analysis process, the researchers often felt the strong curiosity to get to know the participant in person as they came out vividly as live characters fromtheir online discourse. Also the nature of the medium had limited the communication cues (Daft & Lengel, 1984; Fulk et al, 1990), and the researchers felt some personal contacts with the participants might have helped interpretation of the discourse, or might have led us to a more in-depth understanding of the group dynamics as well as the problem solving process.

We did line-by-line coding to generate initial ideas and categories and tired to discover the relationship among concepts, or nodes as referred to in NVivo. The researcher first coded five files line by line, using only free nodes to get a sense of the data. As inducted from the data, we noticed that the transcripts could be categorized into four major groups of codes, team process related, task related, media related and relationship related, which were referred to as tree nodes in NVivo. The four categories were also consistent with literature on teams in organizations

[13] We think it *is* observation, which happened to be occurring online. Having obtained participants' consent, the lead researcher still felt facing the ethical issue of 'lurking" while observing the online collaborations.

(e.g. Guzzo & Dickson, 1996) and information and communication technology (e.g. Daft & Lengel, 1984; Fulk et al, 1990; Fulk, 1993; Gunawardena, 1995). So we re-organized most of the free nodes into the four major themes as tree nodes in NVivo, task-related, team process, relation related and media-related, each with extended nodes under it. In the coding process, we used the tree nodes to help categorize ideas and identify the team collaborative process and quality. In the coding and recoding process, we constantly needed to add, change or modify the nodes and their relationships as indicated in the tree nodes structure, since our interpretation and understanding of data was developing and merging throughout the process.

As the data indicated that the major theme was task-related, in the late stage of data analysis we started from a key node, interactive collaboration, which was identified as the most important node from task related tree node, and tried to figure out the possible relationships among the nodes. The researchers also used the concept mapping software, Inspiration 5 and the modeling feature embedded in Nvivo to untangle and present the relationship among the key nodes. A model of team discourse was developed later for each approach of the online collaborative forums.

Scholars (Lincoln & Guba, 1985; Moustakas, 1994; Stake, 1995; Creswell, 1998) suggest the application of various techniques to ensure the quality of qualitative research. We invited colleagues and peer researchers for review and debriefing throughout the research. In addition, the first author met with a colleague twice a week in the data analysis process to discuss and reflect upon the research process and to ask for an outsider's opinion on the interpretation and coding of the data. Also the researchers were constantly engaged in academic discourse with peers for alternative interpretation and representation of the data in lively discussions. The scholarly communications between the researchers and with peer researchers helped to validate and establish trustworthiness of the research. Also with the concept mapping and the QDA software, the researchers were able to constantly refine the coding and analysis through the research.

Findings

A model was developed for each type of collaboration forum to represent the major findings of this study. (figure 1, figure 2 inserted here.) As indicated in the model, there are two major differences between the online discourses in the two types of forum, peer-controlled and structured and moderated. One was the presence of strategy that guide through the four major themes (i.e. task-related, interaction pattern, relationship-related and media-related). The other was the strength of interactive collaboration.

Discourse occurred in the structured and moderated forums started with a strategy, in the form of a proposal for or discussion of a strategy, which then generated shared agreement on how to process the problem solving assignment as a team. Such strategies often included two aspects, one about team processing, (which was reported in the models as interaction pattern, because the researchers decided that the two-week discourse was too short and not rich enough to determine the team processing pattern) and another for the team task. Many teams started with a clarification of membership, since they were re-forming a self-selected group, and started with questions, suggestions or statements on how to collaborate on this assignment.

Interactive collaboration as merged from the data was conducted through simple agreement, agreement with elaboration, question and answer, and disagreement. In forms of information seeking, asking/providing clarification, challenging other's ideas and further questions that led to active learning beyond the scope of the original task. Through interactive collaboration, participants experienced self-reflection and critique, made connections and comparisons with previous learning, and searched and utilized other resources. Such interactive collaborations did happen in both types of forum, yet it was evident that in the structured and moderated forums, groups had more intense and orderly interactive collaborations and did achieve active learning through the collaborative inquiries, while in peer-controlled forums groups often stayed with individual and/or fragmental reasoning and many left the forums without any interaction or collaborations. The one-way, individual reasoning, together with simple agreement without reflection or elaboration on it, fail to lead the teams experience real collaborative learning and thus lost opportunities for shared active learning. Simple agreement, which happened very often in the peer-controlled forums, indicated only shallow, superficial, interactive collaboration, if we considered it as collaborations at all.

Starting with a strategy, or the efforts to build some strategy in the early stage of the task also helped the teams to establish a mutually agreed interaction pattern with people taking the leadership role and organize the collaboration in a well-accepted fashion. Such efforts were evident in the structured and moderated forums and the interactions thus were more clearly organized and processed. Yet in the peer-controlled forums, teams either did not interact at all or did it in a more or less chaos or similar manner.

Closely related to the interaction pattern and task-related themes were the relationship-related issues as indicated in the data. Teams that showed mutual respect and provide support and encouragement to one another were also showing interaction patterns in an orderly manner, and had more frequent and in-depth interactions with one another. In peer-controlled forums, teams either went off-topic and spent a lot of time in the online forums on relationship-related issues or did not show any evidence at all on team member relationships.

Online forums at the time the data was collected were, and probably still are, a new medium for learning as well as communication. Part of the task-related and interaction patterns, as shown in the data, was about the team collaboration media. Teams chose different media to meet their needs for collaborations at different stage of team problem solving. Those choices varied from team to team. Yet it was clear to the researchers that the choice of medium that matched their needs was critical for the successful of team collaboration process and relationship-related issues.

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